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ABSTRACT

The need for a management information system for a community college is developed. Based on this need, a system is outlined. The system and data base are modular in structure. The modules included are: (1) Student, (2) Personnel, (3) Financial, (4) Facilities, (5) Community Information. Examples of the data which are part of each module are suggested. Possible outputs, both those which are operational and those which provide specific management information, are listed. In addition, the major components of the system are outlined. A planning and forecasting simulation model is proposed as part of the system. Utilization of this model will enable the decision maker to project future resource allocations and demands, using the data contained within the data base to drive the model. (Author)

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A

MANAGEMENT INFORMATION SYSTEM

FOR A

COMMUNITY COLLEGE

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February 1973

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I. INTRODUCTION:

The two-year community college is a relatively new and expanding segment of the educational system. In its short lifetime, the community college system has experienced a phenomenal growth. Campuses have been built. Student bodies have expanded tremendously. Budgets and expenditures have skyrocketed. Demands for new programs to be introduced in the system have far exceeded the resources available to meet these demands. In short, the community college has become a major part of the educational system.

However, such growth has not been without problems. The administration of a community college is a complex task requiring the administrator to consider many factors in his decisions, so as to provide the optimum long-range effect on all sectors of the organization. The recognition of this complexity and the need for improved decision making has not always been the case in the educational system. As Frances E. Rourke and Glen E. Brooks have so aptly stated in relation to colleges and universities:

> "In the past, the development of institutions of higher education has been very much a response to the pressures and opportunities to which they were subject. Such strategy as they have followed in institutional planning might best be described as one of organizational opportunism. Rather than tailoring decisions on their own development to fit a preconceived notion of the kind of institution they wanted to become, colleges and universities have, more often than not, become whatever their situation forced or allowed them to become." [1]

In other words, administrators have been forced to react rather than act in their decision making. To a large degree, this reaction has been the result of a lack of full understanding of the impact of the various courses of action which could be taken. The lack of understanding is not a result of incompetency on the part of the administrator, but rather the result of a lack of data and information upon which to base decisions. Given little data as to the current status of the organization, and the relative merits of various alternative courses of action, the decision maker has been forced to react to financial pressures as well as those exerted by faculty, students, and alumni.

With the proper data and a better understanding of his organization, the decision maker could have the required supporting information available to back up his decision if it were at odds with the pressure being exerted. Without such information, he has no solid factual base upon which to take a given action.

In addition to a reliable data base, the decision maker needs a management information system to convert the data to the necessary decision making information. Since the term "management information system" has been widely used and abused, an operational definition of a management information system (MIS) will be developed.

II. WHAT IS MIS

To paraphrase Koontz and O'Donnell, the task of management is to create for a group the internal environment which is necessary to accomplish the group goals. The objective function of the manager is to maximize the group's goal satisfaction with a minimum expenditure of time, money, unpleasantness or other unsought consequences. In order to coordinate group activity toward optimization of the objective function, the manager plans, organizes, staffs, directs and controls.[2]

The ultimate management information system must provide the manager all the information which he needs to manage (i.e., perform the five functions listed above). This ultimate system can never exist, as it is not possible to provide all of the information since, in many cases, the information required for a specific decision is not even known to the decision maker. Thus, one must accept the fact that a management information system must occur in a less than perfect form.

A management information system is then, in the practical sense, a system which attempts to provide management with as much information as is feasible and desirable at a particular point in time in order to assist management in performing its function. MIS is not an easily definable or fixed system which occurs in the same form for all organizations, rather it is a system which is constantly undergoing change and providing more, better, or diversified information, as may be required by the organization. There is not a specific point when a series of unrelated sub-systems become a management information system. Perhaps more specifically, a management information system exists with the awareness and acceptance of the goals of the information being provided and the willingness, on the part of the decision makers, to coordinate all efforts toward that goal.

Such management information systems could be manual or automated; the information could be stored on organized scraps of paper, or in a fully integrated, computerized data base using random access storage. As was previously stated, management information is a concept; it is not a description of a particular data-based system. However, in the remainder of the paper, the discussion will be centered on the more accepted version of a management information system: the automated data base using the computer for update and access.

III. A COMMUNITY COLLEGE MANAGEMENT INFORMATION SYSTEM:

What is desired now is a more specific operational definition as to the

characteristics of a community college information system. The first characteristic of a true information system is that it is based upon an analysis of the information flow for all of the functional areas of the community college. This analysis determines the following:

(1) what information is presently available;

(2) what information is available, but not needed;

(3) what information is not presently available, but needed;

(4) where the data necessary to provide this information can be found;

(5) how the data should flow through the system;

(6) where and in what form the data should be kept;

(7) who should be responsible for providing the original data.

Such an analysis will provide the foundation of knowledge necessary for the creation of a sound information system.

Secondly, an information system must be based upon a fully defined data base. Ideally, this data base will be fully integrated; i.e., each individual submodule fits with each other submodule in such a way that any specific datum entering the system from one source can be stored in one place with access to this datum available to all other submodules of the system. However, that the system be fully integrated is not a requirement, and, in fact, in actual practice, is a difficult objective to accomplish. What is imperative is that the data be concisely defined and organized in the data base, and that the relationships between the data from various operational systems be clearly distinguishable.

To determine what data to keep in the data base has become a paradox for information system designers. As John Gwynn, Associate Director of Project INFO states, "Since it is impossible to state how information is going to be used, it is likewise impossible to determine what information is most useful in making a decision. Now that is the crux of the problem!" [3] This author feels there is no easy solution to the problem. If one attempts to find such a solution, he risks the chance that his efforts will keep him from attacking the real problem of defining and organizing the data base with the data which are accepted as being required. If such a data base is built with the knowledge that it is incomplete, and if the designer is careful to allow the system to be open-ended, the future addition of data which are found to be required can be facilitated. As was stated earlier, a management

information system is an evolving concept rather than a specific design for a system.

The third criterion for an information system is the ability to retrieve data from the data base in such a way as to provide information for the decision maker. Such retrieval may be the result of individual reports which are pre-planned and programmed, it may be the result of exception reports which occur only when certain pre-defined situations arise, or it may be the result of a general retrieval of data using an open-ended, generalized retrieval system. Each of these methods is important, and it is necessary that each be present if an information system is to occur in a usable form. Too many systems have as their bottleneck the requirement that all information from the system must flow out through pre-planned and scheduled reports. This requires that great amounts of data be processed on a regular basis and then be perused by the decision maker to determine if any action is required (e.g., monthly accounting statements). Such a method also requires that, if information is desired which was not pre-planned, it is necessary that a programmer be made available to program a report for this information. This report, then, usually becomes a part of the normal processing of data, and continues to produce the information long after there is any need for it. Thus, if the system is to be flexible and responsive, it should incorporate the use of exception reporting and a generalized retrieval system.

George W. Baughman describes the basic technical features which should be present in a management information system:

> "The system should incorporate basic technical features that are compatible with management needs. For example, such features as: (1) common data bases, where each contributor enters the data he is best able to supply with no redundancy of prime sources, (2) common coding schemes for related data identifiers, (3) integrated systems design, so that parochial views are not permitted to deter logical relationships between separate processes, (4) timely processing and availability of data, (5) few judgment decisions to get data into the system, (6) consistency in reporting through the use of agreed upon data sources and points in time, and (7) reliability, in that the systems are balanced, edited, and controlled in a way that assures considerable protection to the suppliers (in that they will be prevented from making major errors) and to the users (in that the data will be the best available)." [4]

IV. NECESSITY FOR PLANNING THE SYSTEM:

As is evident from the above discussion, a management information system does not evolve naturally as a part of the growth of an institution. The system, if it is to serve the needs of management, must be well planned. Such a planning process must consider the results which are desired from the system as well as the data which must be stored in order to produce these results. The costs required to gather, edit, and store unnecessary data, or conversely the opportunity cost of not having the proper information available, are high.

Among the many factors which this planning process must consider are:

(1) the specific data items which will be stored;

(2) the provision for addition of new data items, and deletion of unnecessary data items as the information needs of the organization change;

(3) the flow of data through the system;

(4) the responsiveness of the system to requests for information;

(5) the assurance of accuracy of data within the system;

(6) the optimal use of storage methods to organize the data so as to eliminate redundancy and to lower the cost of entering and retrieving data;

(7) the best method and source for gathering the data;

(8) the delegation of responsibility for maintaining the various data of the data base;

(9) the determination of priorities for implementation of the segments of the system.

Such a planning process must involve representatives of the various functional areas of the community college. The development of an information system requires the commitment of top management in order to assure that the participation within the planning process is meaningful. Without such commitment, individuals interested in protecting their own status can cause irreparable damage to the system.

The necessity for the involvement and participation of representatives of functional areas within the community college cannot be understated. As Caffrey and Mosmann stated in their book Computers on Campus:

> "The administrator must ultimately think of it (the system) as our system not theirs (the center's). In a student information system, for example, it is the Registrar's responsibility to see that the system suits the needs of the college and allows him to perform his job in the way he understands it needs to be done. If he abrogates this responsibility, and lays it upon a technician who knows about computers but not about registration at this college, the chances of success are diminished."[5]

Some of this attitude may be attributed to a fear of changing the status quo and replacing it with the unknown. This may take the form of heel dragging, especially in the lower ranks. Thus, the new system must be explained thoroughly in order that all will see why it is being installed and how it will enable them to do a better job. It should not be presented as a challenge to competency or job security.[6]

V. A GENERAL DESCRIPTION OF A COMMUNITY COLLEGE MANAGEMENT INFORMATION SYSTEM:

The decision maker within a community college system is concerned mainly with the allocation of scarce resources such as faculty, dollars, and facilities in such a way as to meet the demands placed upon the system. As a result, the management information system must provide information concerning the current allocation and availability of resources, as well as the current demands upon the system. In addition, the management information system must provide a method for forecasting future demands and also provide methods which can test various alternative resource allocations against the forecast demands.

The management information system should be designed in a modular manner with each module representing a function within the community college. Such a modular design provides the opportunity for the gradual implementation of the system within functional areas while providing for the overall co-ordination and integration of the system.

The major modules within the management information system for a community college are:

(1) Student Module;

(2) Personnel Module;

(3) Financial Module;

(4) Facilities Module;

(5) Community Information Module.

Each of the modules is presented in some detail in the following discussion. Presented for each module are:

(1) Subsystems within the module;

(2) Examples of data included in the module;

(3) Examples of types of output which can be obtained.

A. Student Module:

The data stored within this module is that data which it is desirable to maintain concerning individual students attending, planning to attend, or who have attended the institution. The subsystems within the module can be considered as those related to:

(a) Admissions data;

(b) Current student data;

(c) Alumni data.

In each of these subsystems, a further breakdown can be made of the data to be stored. For each subsystem, the following is given as examples of the kinds of data which might be stored:

(1) Admissions data

(a) Individual applicant data

- name
- social security number
- address
- high school address
- sex
- birthdate

- parents' name and address
- applicant status
- high school grade point and College Board scores.
- desired major
- desired student status

(b) Historical applicant data

- number of applicants by major by year
- number of admissions by major by year
- number of matriculating students by major by year
- number of transfer students matriculating by major by level by year

(2) Current student data

(a) Individual student personal data

- name
- social security number
- local address
- sex
- race
- birthdate
- marital status
- parents' name and address
- major course of study
- class level

(b) Individual student current course data

- current course names, numbers, sections
- current course location
- current course credits
- current course grade
- pre-registration data for the next semester

(c) Individual student previous course data

- previous courses taken
- previous credits earned
- grades for previous courses
- dates previous courses were taken

(3) Alumni data

(a) Individual alumni personal data

- name
- social security number
- address
- sex
- race
- birthdate
- graduation date
- current employer
- current job title or classification
- previous occupation titles
- additional education and degrees

(b) Individual alumni previous academic record

- degree(s) earned
- courses taken
- credits earned
- grades received
- dates courses were taken

Figure 1 provides a schematic of the organization and flow of information in the Student Module. Data is stored within the system as soon as it is available and is thereafter maintained only as the data changes. For example, personal data such as name, sex, major, etc., are entered as they become known for the applicant for the college. If an applicant matriculates, the status is changed and the data becomes a part of the current student file. Upon graduation, the data becomes a part of the alumni file.

Many outputs can be obtained from such a system, both in terms of management information and operational reports and procedures to smooth student data processing. Examples of the types of operational output which can be obtained are:

(1) automated grade processing and computerized grade reports;

(2) current class rosters;

(3) computer production of transcripts;

(4) student directory;

(5) mailing labels;

(6) pre-registration and registration processing.

In terms of management information, examples of the kinds of output available are:

(1) data from which estimates of future enrollments can be made;

(2) student flow projections;

(3) demand for specific courses generated by enrollments in given courses of study;

(4) longevity studies on employment patterns of alumni;

(5) class loads by level of course and discipline.

B. Personnel Module:

The Personnel Module is that section of the data base which stores data concerning the employees of the college. This module can be subdivided into the data which relates to the payroll function of the college and that data which relates to the more general personnel function. Thus, the subsystems within the Personnel Module are:

(a) General personnel data;

(b) Payroll data.

Examples of the kinds of data which should be stored within the Personnel Module are:

(1) General personnel data

(a) Individual employee personal data

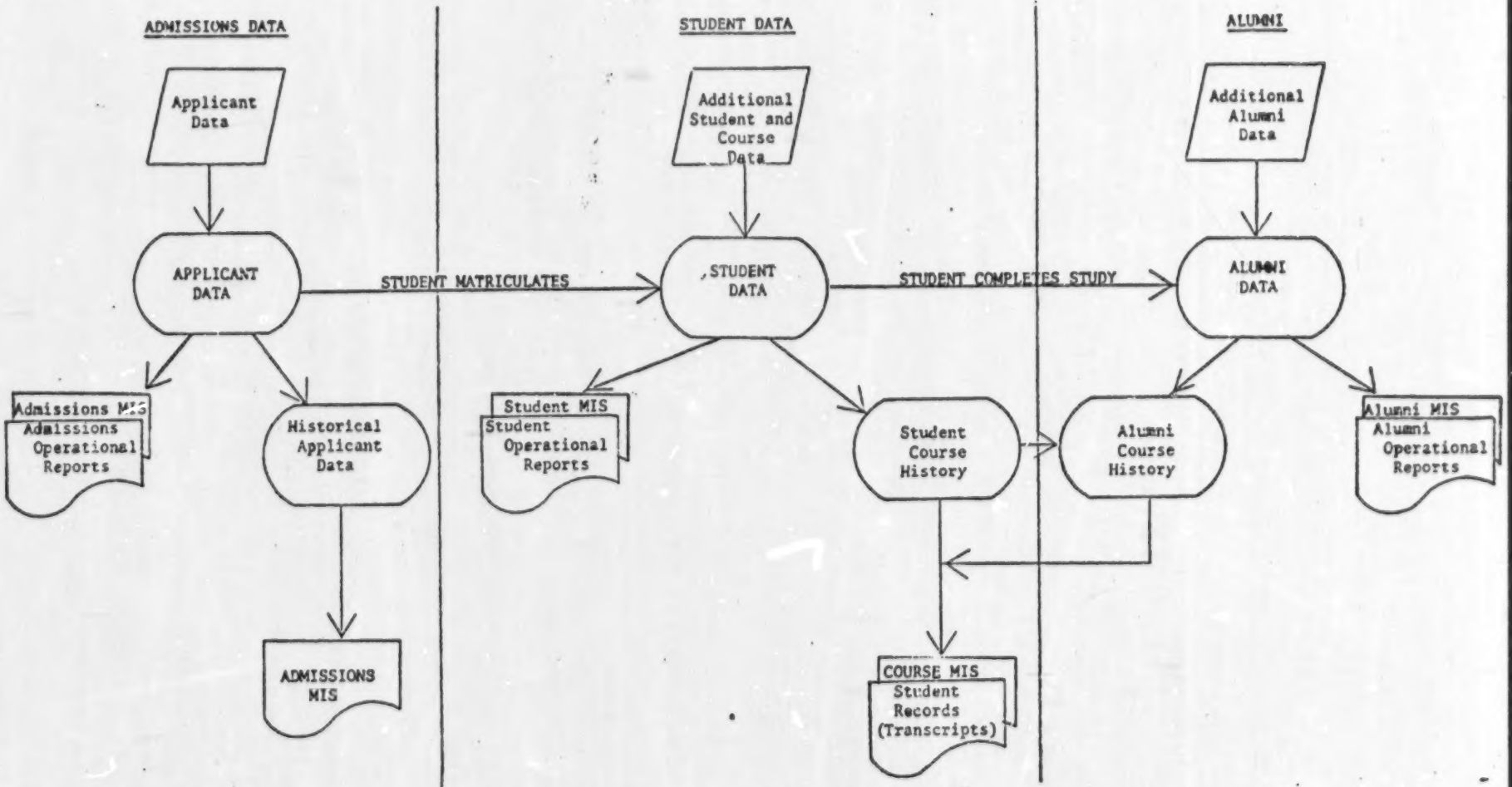
- name
- social security number
- sex
- race
- address
- campus address
- home phone
- campus phone
- employment date
- job title and classification
- education and skills

(b) Individual faculty assignment data

- classes taught
- advisees
- laboratories

FIGURE 1

STUDENT MODULE



- extra duties assigned

(2) Payroll data

(a) Individual general payroll data

- number of exemptions
- marital status
- deductions
- year-to-date deduction amounts

(b) Individual appointment data

- salary or hourly rate
- distribution accounts
- distribution percentage rate
- distribution rates to programs
- year-to-date salary payments

As in the case of the Student Module, both operational and management information outputs are obtained from the system. Examples of the operational outputs which can be obtained are:

(1) payroll checks;

(2) payroll reports;

(3) automatic distribution of payroll to the accounting system;

(4) employee telephone directory;

(5) compliance reports.

Examples of the possible management information outputs are:

(1) individual faculty course and student loads;

(2) faculty and student loads by discipline;

(3) distribution of personnel costs by program within a Planning Program Budgeting System (PPBS);

(4) turnover information;

(5) staffing by functional area within the community college;

(6) individuals possessing certain education or skills within the

system.

C. Financial Module:

This module includes that data which relates to the financial operation of the college. Included in the module are four major subsystems. These subsystems are:

(a) General ledger data;

(b) Accounts payable data;

(c) Accounts receivable data;

(d) Program budget data.

Examples of the kinds of data which may be found in these subsystems are:

(1) General ledger data

- account description
- account number
- expense or income code
- budget
- current period expenditures or income
- year-to-date expenditures or income
- detail transactions

(2) Accounts payable data

- vendor name
- vendor address
- description of charges encumbered
- amount encumbered
- date encumbered

(3) Accounts receivable

- student social security number
- current balance
- itemized charges and descriptions

(4) Program budget data

- program identification number
- program description

- program budget
- program current expenses or income
- program year-to-date expenses or income

Examples of operational reports or procedures available within the Financial Module are:

(1) income-expense reports;

(2) financial statements;

(3) student invoices;

(4) vouchers;

(5) automated budgeting.

Examples of management information available are:

(1) exception reports for accounts overspent;

(2) summarization of financial data consolidated by functional area;

(3) summarization of income and expenditure by program;

(4) analysis of expenditures by category;

(5) cost data related to students, classes, or discipline offering.

D. Facilities Module:

This module includes all data as related to physical facilities and equipment which are present within or available to the community college. Examples of the data items which might be included within the Facilities Module are:

- type of space
- location
- size in square feet
- capacity
- current utilization schedule
- equipment type
- current value of equipment
- location of equipment
- general condition

Operationally, the data available within this module can provide for such things as:

(a) Basis for room assignments at registration;

(b) Availability of space for meetings;

(c) Basis for the assignment of physical plant personnel;

(d) Basis for the assignment of costs for facilities and equipment to accounts or programs.

In the management information sense, this data can provide for such information as:

(a) Utilization of current space;

(b) Projections concerning needs for additional space;

(c) Facilities which are under-utilized.

E. Community Information Module:

The data which is stored within this module is that data exogenous to the system which has a major effect on the planning, demand placed upon, and resource allocation of the community college. The main reason for including such data is to provide the community college with planning information related to the environment in which it must operate. Examples of the kinds of information which would be included within this module are:

- census tract data
- location and description of secondary schools within the area
- location and description of major employers within the area
- employment pattern by category of employers within the region
- location of other higher education facilities within the area.

Examples of some of the management information outputs which might be obtained are:

(a) Projections of student demand by discipline;

(b) Projections of employment needs by job category and

discipline;

(c) Local income data to provide factors affecting tuition/ demand elasticity.

VI. THE INTEGRATION OF THE MODULES:

Although each of the modules has been discussed separately, there is a need to assure that the total system is ultimately an integrated system. That is, the system should provide for maximum communication of data between modules. Benefits of such a system include:

(1) A single source of data entry and storage results in non-duplication of effort and consistency of data stored;

(2) A single source of data maintenance clarifies the responsibility for accuracy of the data;

(3) Communication between modules can be automated;

(4) Responsibility for edit and control of the data rests at one point in the system.

As an example of how the integration of the system can operate, consider the distribution of payroll to the accounting system. The Personnel Module contains all of the information necessary to make such distribution of payroll charges to the accounting system. Thus, during the calculation of the pay, the distribution is also calculated and an internal computer transaction is created to update the Financial Module. All of the actual calculation and update is done internally without need for human intervention.

Other examples of the results of an integrated system include:

(1) Faculty load information which uses data from the Personnel and the Student Modules;

(2) Registration of students which uses data from the Student, Personnel, and Facilities Modules;

(3) Student billing which uses data from the Student and the Financial Modules.

Figure 2 presents a schematic of the total integrated system.

VII. THE SYSTEMS FLOW:

There are five major functions which should be provided within the information

system design. These are:

(1) An efficient method of data gathering;

(2) A strong edit and control of the data entering and being stored within the data base;

(3) The ability to add, delete, or change any datum within the data base;

(4) Clear and concise reports for regular information requirements;

(5) A general retrieval which allows requests for subjects which meet any specified combination of characteristics.

These characteristics are illustrated in Figure 3.

The need for a strong edit and control of data and a general retrieval capability cannot be overemphasized. Systems not possessing these characteristics are doomed to, at best, mediocre results. Without a strong edit and control, one cannot be sure of the accuracy of the entering data, and as the old saying goes, "garbage in -- garbage out". Secondly, even if all the necessary data required were to be stored accurately, the system can be unresponsive to management's needs unless a simple method for obtaining special required data combinations is available. If every request for nonscheduled information required that a programmer write a report program to obtain this information, the response of the system would be so slow that it is unlikely the information would still be needed. The users would soon give up trying to get anything from the system.

VIII. THE MODE OF OPERATION:

The writer has not, as of this writing, considered the mode in which such a system will operate; i.e., whether batch or on-line. At this point, this question is not of major importance, and, in fact, can only be answered for each specific application. If normal turnaround time for data entry or retrieval can be one day, the batch method can be utilized. On the other hand, if immediate update and response of the system is required (as in an airline reservation system), the on-line approach, using terminals is most appropriate.

IX. A PLANNING MODEL AS A LINK IN THE INFORMATION SYSTEM:

Management information was defined as the information needed to manage and that this information must provide for the five functions of management: planning; organizing; staffing; directing and controlling. The planning model is an integral part of the management information system. It assists

FIGURE 2

INTEGRATED SYSTEM

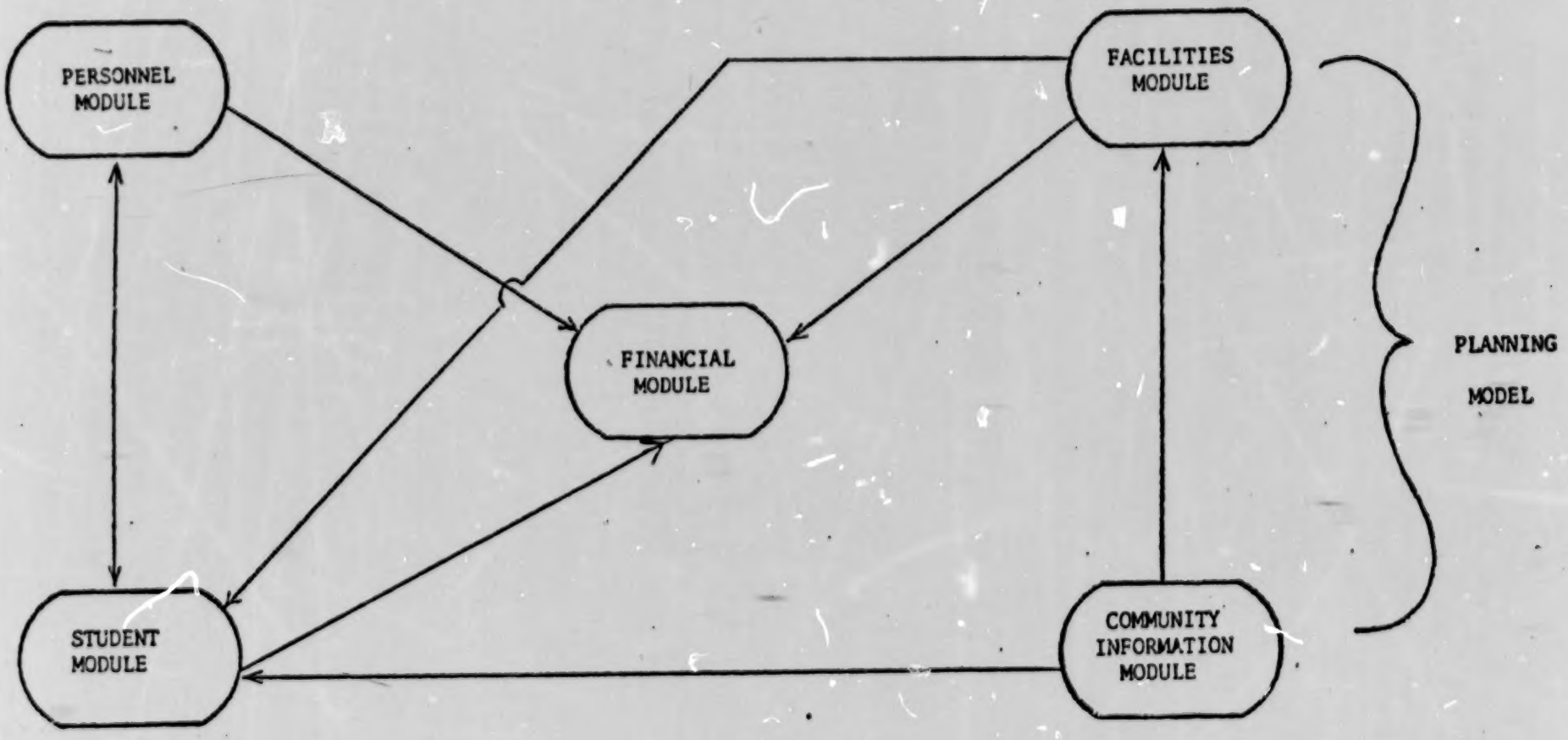
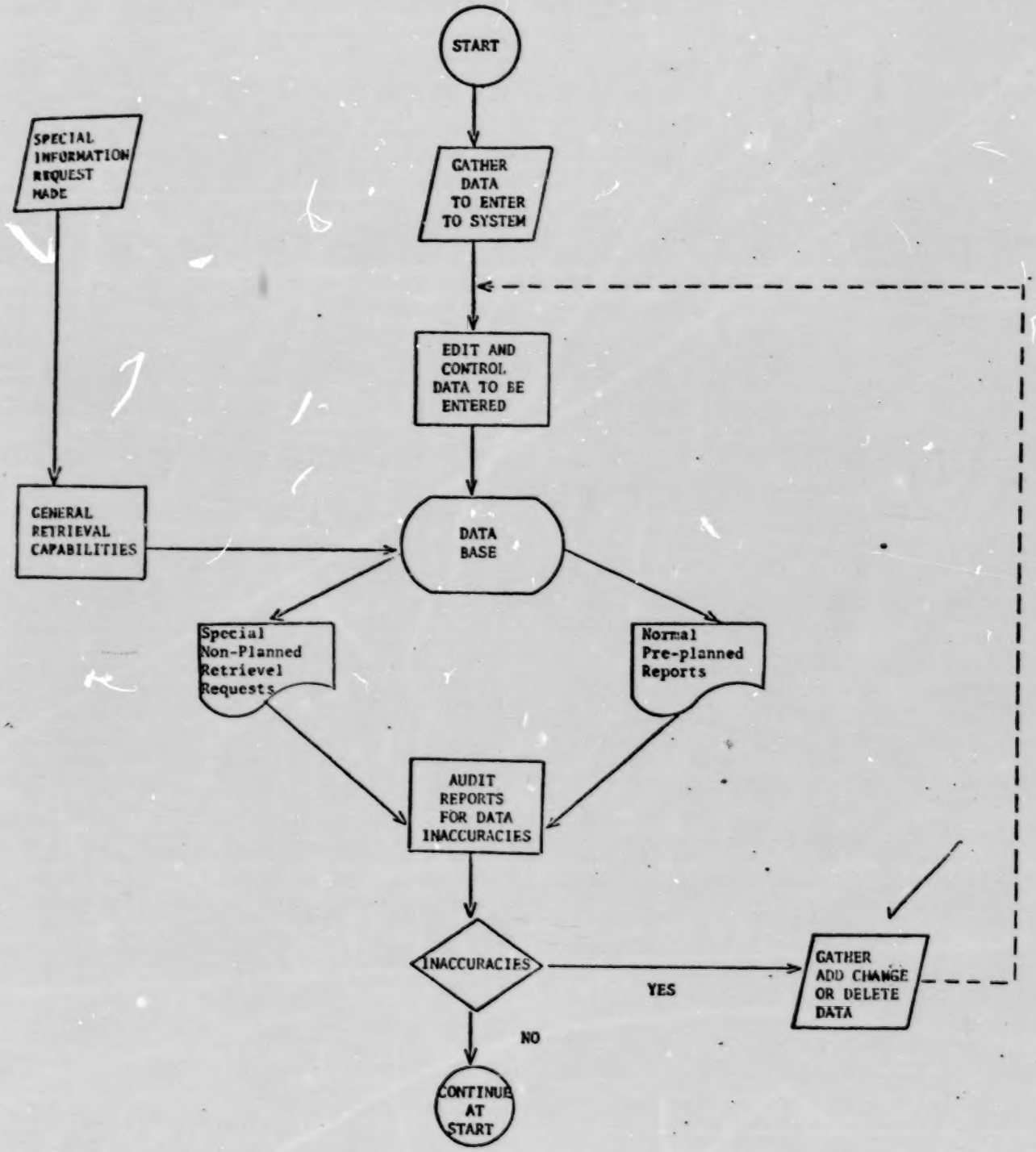


FIGURE 3

THE SYSTEMS FLOW



the decision maker in two of his major functions: planning and controlling. In addition, it can assist the manager in obtaining an understanding of how his organization functions; what interactions are present; and what effect changes in plans and structures will have upon the long-term position of his organization.

As was stated earlier, the community college is a complex organization. The many implications of a decision are not always evident to the administrator. He is forced to make his decision without a complete analysis of all the possible consequences. The planning model can help him to understand the implications and long-term effect of his decisions without having to make a decision and await the real-life outcome. Robert K. Thompson describes the modeling of a university as allowing the administrator to observe the dynamic behavior of the institution and to test hypotheses concerning its behavior before the actual decision to be implemented is carried through.[7] Emshoff and Sisson state the same premise in a more general way: "It is a view of operations research that model construction, even without absolute optimization, is important because it results in a forward-looking point of view; ..."[8] Another backer of the use of modeling in higher education is R. A. Wallhaus who points out that:

> "Models in higher education can help to explain issues which arise in planning the direction that an institution is to take in the future, and thereby aid in formulating educational and administrative policies. The most effective use of modeling in education is as a tool to provide information in the form of decision alternatives, cost estimates, and indications of probable results."[9]

Therefore, modeling provides the tool which the administrator can use to carry out the planning function of his job. Modeling can also provide for the control function, as the results of a decision made in real life can be compared to simulated results obtained from the model and, given the model's validity, this comparison can provide a control point for the manager. Thus, the planning model is an important link in the management information chain. It provides a point of view for the system which cannot be provided in any other way. In fact, for a true management information system to be developed, a planning model must be in its design.

X. A BRIEF DESCRIPTION OF THE PLANNING MODEL:

The model which is presented here was developed by the author and is operational for a university setting.[10] It deals with both resource allocation and revenue generation; it is deterministic and recursive. However, Markov and stochastic techniques are used for student enrollment forecasting, and research revenue forecasting, respectively. The planning horizon for the model is ten years, and in some cases, it is possible to process ten years

of historical data, using least squares estimation.

The general areas covered by the model are:

(1) applicant and student enrollment forecasting;

(2) credit hours generated by and required faculty to teach the forecast enrollment;

(3) forecast of research projects and required staffing for these research projects;

(4) costs generated by selected instructional and research levels of aggregation;

(5) endowment income and capital gains projections;

(6) net income forecast for planning horizon in each area and the total university.

Each of the above represents a separate module of the model. The data required to operate the model is contained within the description of the data base presented above.

The objectives of the model are:

(1) to build a general planning and forecasting model for a university which can be adapted for use in any institution of higher education;

(2) to indicate the integration of this model with a data base for the university information system;

(3) to design the model so that expansion or revisions are simplified;

(4) to integrate within the model both resource allocation and revenue generation;

(5) to include forecasting for organized research;

(6) to aggregate all data from the various forecasts and allocations so that for each functional area a net income or loss statement along with comparative costs per degree and student/faculty ratios are generated;

(7) to complete the study and model using a general systems approach in order that the model can be easily implemented at any university

or college.

In order that the model be flexible and expansible, it was constructed in separate modules, with no linkage between them except for the information passed through the data base. Figure 4 contains a general schematic of the model structure.

The model is broken down into eight separate modules:

(1) the enrollment module;

(2) the faculty requirements module;

(3) the research forecast module;

(4) the cost requirements module;

(5) the endowment module;

(6) the report module;

(7) the initializer module;

(8) the build module.

Each of the modules is a self-contained computer program. This method allows for expansion of the model. If it were desirable to add a space allocation model, or an auxiliary services model, a separate program could be written using the existing data base. Modification would then be required only to the initializer and build modules to add any files or data items to the data base.

If it is desired to run the entire model with a given set of data, it is necessary to follow a specific sequence in executing the programs. The required sequence is illustrated in Figure 5. However, a major advantage is the model's flexibility, which enables many of the modules to be operated independently. For example, if it is desired to obtain an enrollment forecast or a research forecast, the analyst needs to load into the system only the applicable required base and decision data before executing the proper module.

Another contributing feature of the modular design which enhances the model's flexibility is that intermediate reports can be analyzed, and changes to the data base can be made using the build module, if the intermediate results indicate that this would be desirable. In addition, these reports provide the required output if a module is operated independently.

Using this model, the decision maker can test the effect of various alternative resource allocations given specific demands. Examples of the kinds of information available to the decision maker are:

(1) effect of various tuition and student aid policies upon the financial resources of the institution;

(2) effect on class load and faculty required in each discipline when changes in enrollment in specific disciplines occur;

(3) effect of salary and fringe policies upon the financial resources of the institution;

(4) enrollment and applicant forecasts by level and discipline within the institution;

(5) cost/income projections for specific functional areas of the institution;

(6) effect of investment policies upon the financial resources of the institution;

(7) research and research requirement forecasts by discipline.

XI. CONCLUSION:

The community college management information system outlined in this paper can provide community college decision makers with that information which is necessary to efficiently operate the institution. In addition, the operational reports and procedures which can be developed as a part of the system provides the institution with additional benefits. The addition of a planning and forecasting model as an integral part of the system enables the decision maker to project resource allocations and demands upon the system. Thus, the total system provides the decision maker with the ability to act rather than to react in the fast-moving, complex environment.

FIGURE 4

THE STRUCTURE OF THE MODEL

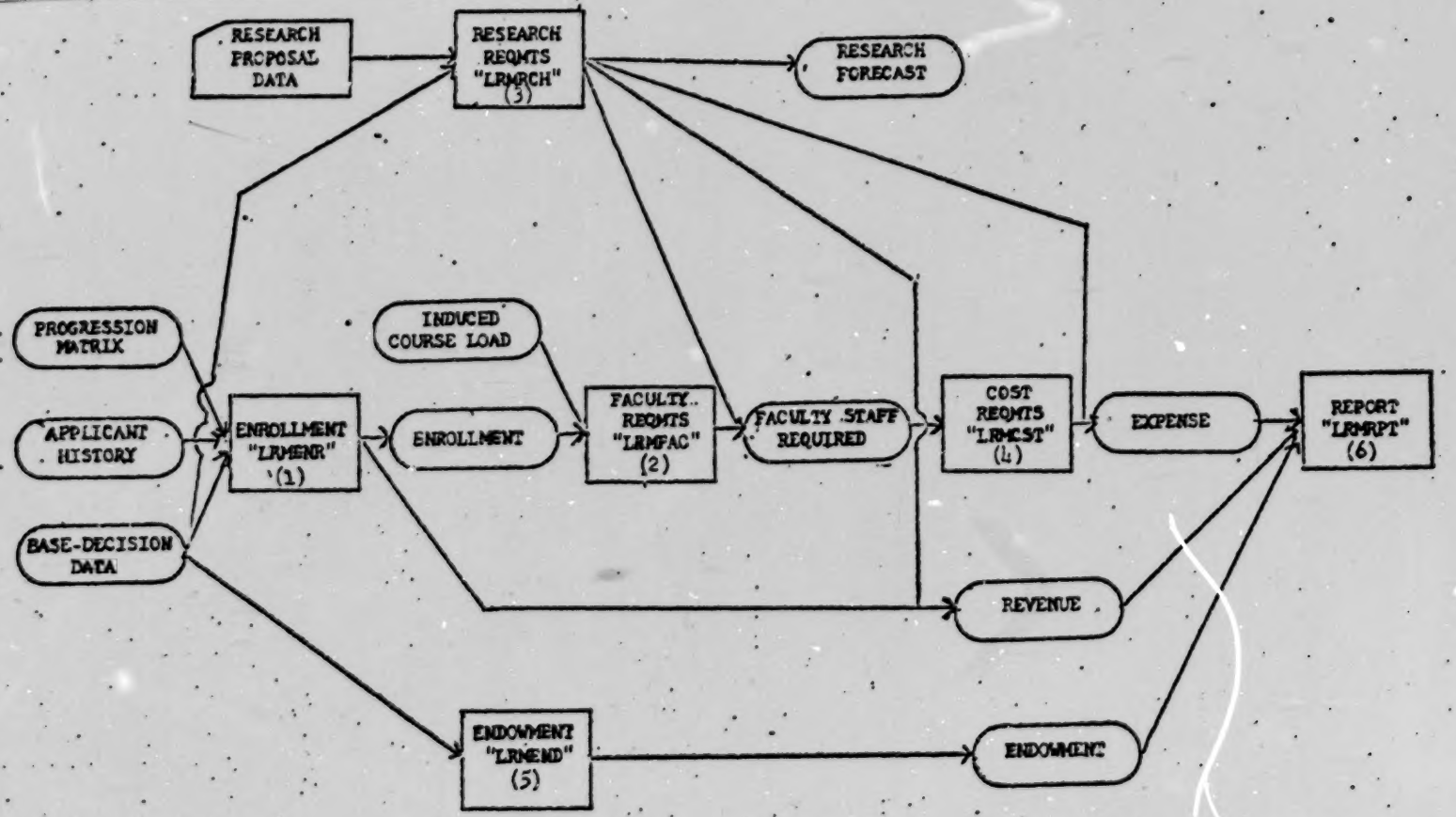
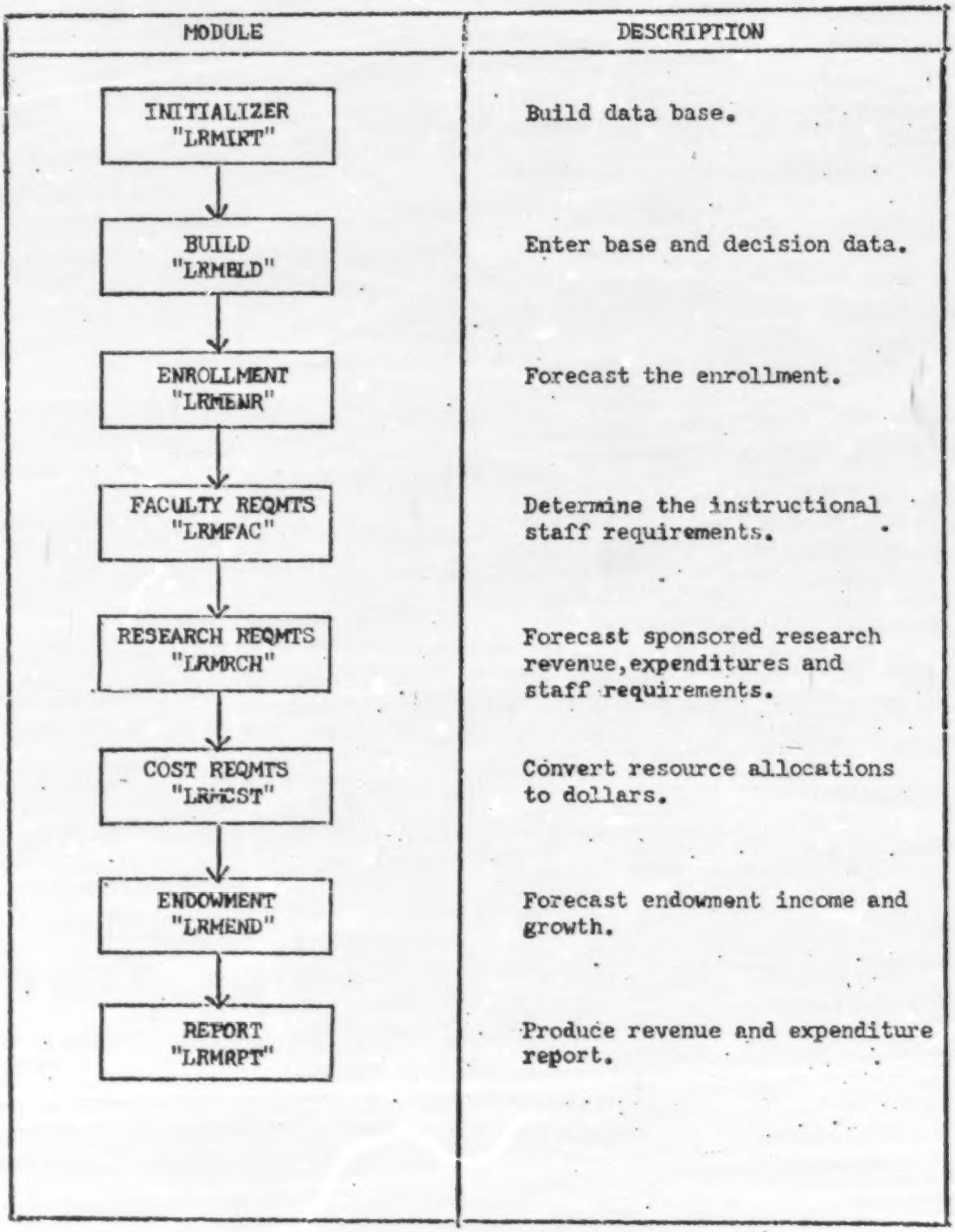


FIGURE 5

THE SEQUENCE OF MODULE EXECUTION FOR OPERATION OF THE MODEL



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